CGAL periodic volume mesh generator

Aymeric Pellé, Monique Teillaud

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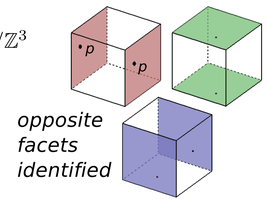
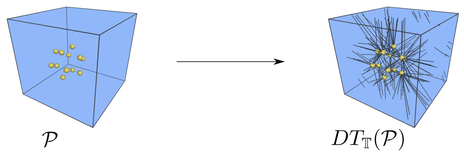
Periodic Delaunay triangulation [CT09]

Flat torus : $\mathbb{T}^3 = \mathbb{R}^3/\mathbb{Z}^3$

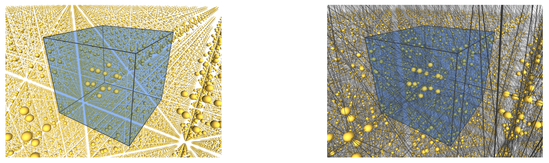


A *finite* computation
for an *infinite* structure



$\mathcal{P}$
Input point set

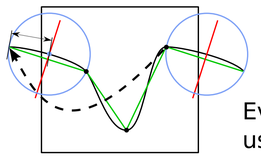
$DT_{\mathbb{T}}(\mathcal{P})$
Delaunay triangulation in $\mathbb{T}^3$



$\mathcal{P} + \mathbb{Z}^3$
Infinite point set

$DT(\mathcal{P} + \mathbb{Z}^3)$
Infinite Delaunay triangulation

Periodic refinement criteria



Evaluate the simplex quality
using translated vertices

Criteria

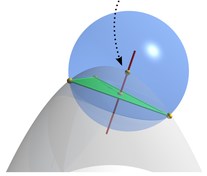
Volume mesh [RY07]

Triangulation

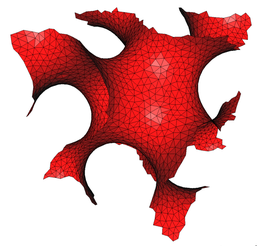
Delaunay Refinement

Criteria
- Shape
- Size
- Distance

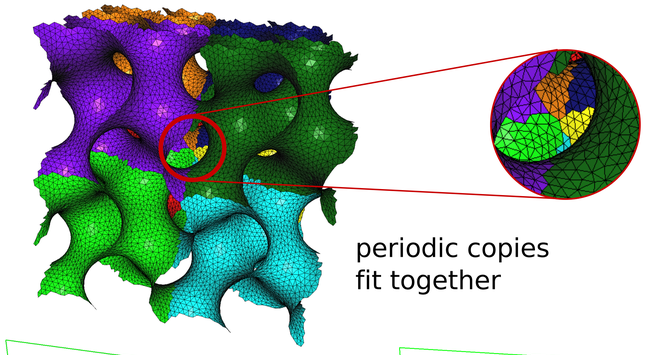
```
while (is_bad(simplex))
    refine(simplex);
```



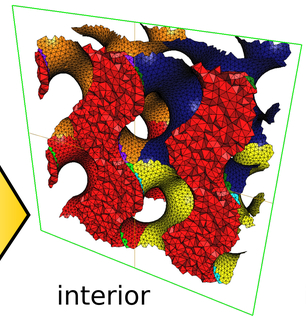
Restricted Delaunay
Triangulation
(case of a facet)



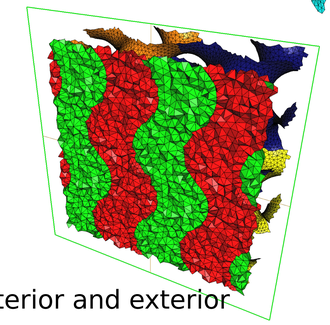
one copy computed



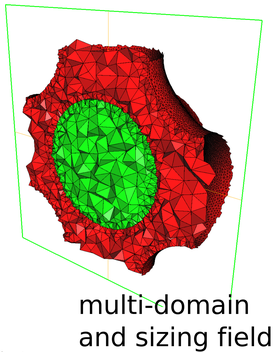
periodic copies
fit together



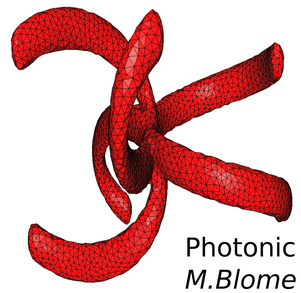
interior



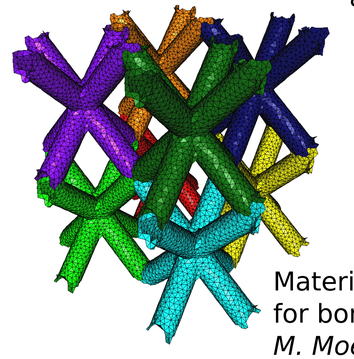
interior and exterior



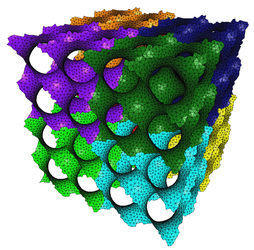
multi-domain
and sizing field



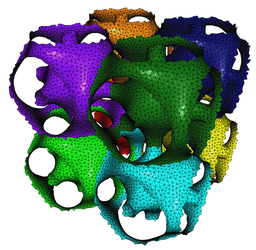
Photonic crystal
M.Blome
Zuse Institute Berlin



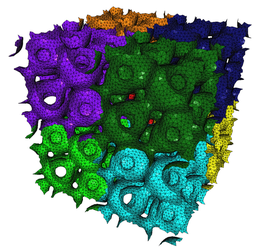
Material
for bone scaffolding
M. Moesen
K.U. Leuven



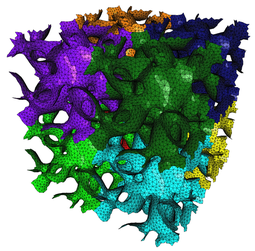
Diamond



Double p



D prime



Lidinoid

CGAL

www.cgal.org

Computational Geometry Algorithms Library

- Open source
- Templated C++ (genericity)
- Robust, Efficient
- Cross-platform
- Academic and Industrial users
- Dual License (GPL & commercial)
- Large variety of packages

In progress
- Meshes on sphere
- Hyperbolic meshes
- Anisotropic meshes
- ...

Geometry Factory

Manuel Caroli and Monique Teillaud.
3D Periodic Triangulations
Pierre Alliez, Clément Jamin, Laurent Rineau, Stéphane Tayeb, Jane Tournois, Mariette Yvinec
3D Mesh Generation

References
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[RY07] *Laurent Rineau and Mariette Yvinec.*
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Meshing 3D Domains Bounded by Piecewise Smooth Surfaces. In *Proc. IMR*, pp 443-460, 2007.

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http://www-sop.inria.fr/members/Monique.Teillaud/ADT-OrbiCGAL/